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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* YASUHIRO ISHII and OSAMU SANO

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Appeal 2008-1425  
Application 09/655,847  
Technology Center 3600

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Decided: July 16, 2008

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Before HUBERT C. LORIN, LINDA E. HORNER, and  
BIBHU R. MOHANTY, *Administrative Patent Judges*.

HORNER, *Administrative Patent Judge*.

DECISION ON APPEAL  
STATEMENT OF THE CASE

Yasuhiro Ishii and Osamu Sano (Appellants) seek our review under 35 U.S.C. § 134 of the final rejection of claims 1-4, 7, 9-12, and 14. Claims 8 and 13 have been canceled, and claims 5 and 6 have been withdrawn. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

Appeal No. 2008-1425  
Appl. No. 09/655,847

## SUMMARY OF DECISION

We AFFIRM-IN-PART.

### THE INVENTION

The Appellants' claimed invention relates to an electric power steering apparatus with an electric motor as a source generating a steering-assist force (Spec. 1:5-7). Claim 7, reproduced below, is representative of the subject matter on appeal.

7. An electric power steering apparatus, comprising:
  - an electric motor for steering assistance;
  - a worm shaft on which a worm is disposed;
  - a steering shaft, configured to engage a steering wheel, on which a worm wheel is disposed and to which a rotary motion of said electric motor is transmitted through said worm shaft;
  - a biasing member biasing, via a bearing, said worm shaft toward said worm wheel;
  - a concave member accepting said bearing; and
  - a housing for housing said bearing and said concave member, wherein the biasing member is movably acceptable only toward the concave member.

Appeal No. 2008-1425  
Appl. No. 09/655,847

## THE REJECTION

The Examiner relies upon the following as evidence of unpatentability:

Eda	US 6,044,723	Apr. 4, 2000
Kamimura	JP 60-191758	Dec. 19, 1985

The Appellants seek our review of the rejections of claims 1-4, 7, 9-12, and 14 under 35 U.S.C. § 103(a) as being unpatentable over Eda and Kamimura.

## ISSUE

The issue before us is whether the Appellants have shown that the Examiner erred in rejecting claims 1-4, 7, 9-12, and 14 under 35 U.S.C. § 103(a) as unpatentable over Eda and Kamimura. This issue turns in part on whether the combined teachings of Eda and Kamimura would have led one having ordinary skill in the art to the claimed invention.

## FINDINGS OF FACT

We find that the following enumerated findings are supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

1. Eda discloses a steering assist system including a rotating shaft (worm shaft) 30 and an electric motor 21 having a rotor (output shaft) 21a (Eda, Fig. 2 and col. 4, ll. 59-62).

2. Eda describes that a serrated portion 30b on the end of worm shaft 30 engages with a serrated hole 21b of the output shaft 21a so that the worm shaft 30 rotates integrally with the output shaft 21a (Eda, col. 5, ll. 3-12).
3. Although Eda describes that it is possible for the worm shaft 30 to move in the axial direction relative to the output shaft (Eda, col. 5, ll. 9-11), the shafts are nonetheless interlocked in a radial direction (i.e., rotatally) by virtue of the serrated portion 30b engaging the serrated hole 21b.
4. As such, Eda discloses that the output shaft of the electric motor is interlocked with the worm shaft.
5. Each of Eda's serrations on the end portion of worm shaft 30 and in the serrated hole 21b of output shaft 21a is an interlocking member.
6. Eda discloses compensating for backlash in an axial direction using spring 10a, disposed between the inner race of a first bearing 8a and a first flange 30c of the worm shaft 30, and spring 10b, disposed between the inner race of a second bearing 8b and a second flange 30d of the worm shaft 30, to provide a predetermined pressure to the bearings so that the worm shaft is supported to have no backlash in the axial direction (Eda, col. 5, ll. 22-45 and Fig. 2).
7. Thus, Eda's system provides for elimination of backlash using a static elastic member.

8. Eda's system does not provide a means to adjust the pressure supplied by the elastic member to the bearings.
9. Kamimura discloses a worm gear arrangement that accounts for backlash by biasing a worm 23 toward a worm wheel 22 using a pressing means, i.e., slider 41, spring 48, and adjustment screw 46 (Kamimura, p. 4, ll. 23-26).
10. In particular, Kamimura is directed to a settable pressing means (spring 48 adjustable by adjustment screw 46) which allows the user to adjust the biasing force of the spring acting in the radial direction of the worm gear 23 (Kamimura, Fig. 1, p. 5, ll. 8-9 and 21-22).
11. Kamimura describes that the pressing means is "set pressing said worm with a set force in the direction of the worm wheel" (Kamimura, p. 1, last line; see also p. 3, ll. 9-10).
12. In particular, Kamimura describes that "[a] spring 48 that energizes the slider 41 toward the worm wheel 22 is inset between said bearing 45 and slider 41, and as a result, the worm gear 23 is pressed by a fixed elastic force toward the worm wheel 22" (Kamimura, p. 4, ll. 23-26).
13. Kamimura also describes that "in cases where the pressure force by said spring 48 changes, the screw-in amount of the adjustment screw 46 can be changed" (Kamimura, p. 5, ll. 8-9).
14. As such, Kamimura describes that, when set, the force of the spring 48 acts only in the direction to deflect or move the bearing

toward the worm wheel, and thus the only acceptable movement of the pressing means is to adjust it so that a force is exerted on the bearing toward the worm wheel.

15. Kamimura discloses in Figure 1 that bearing 43 is rotatably supported in an aperture or cylindrical bore formed in arm 42 of slider 41, and spring 48 is housed between the leg portions of the lower part of slider 41 (Kamimura, Fig. 1 and p. 4, ll. 19-22).
16. As such, when slider 41 biases bearing 43 upwardly, both arm 42 and bearing 43 move such that bearing 43 cannot be deflected into the concave member of the aperture (Kamimura, Fig. 1).
17. The ordinary meaning of housing is something that covers, protects, or supports, especially: a. A frame, bracket, or box for holding or protecting a mechanical part: *a wheel housing*. b. An enclosing frame in which a shaft revolves. *The American Heritage Dictionary of the English Language* (4th ed. 2000).

## PRINCIPLES OF LAW

“Section 103 forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.’” *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the

Appeal No. 2008-1425  
Appl. No. 09/655,847

prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). *See also KSR*, 127 S. Ct. at 1734 (“While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.”)

“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference.... Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art.” *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). *See also In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983) (“[I]t is not necessary that the inventions of the references be physically combinable to render obvious the invention under review.”); and *In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) (“Combining the teachings of references does not involve an ability to combine their specific structures.”). Rather, “if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR*, 127 S. Ct. at 1740.

## ANALYSIS

### *Claim 7*

The Appellants contend that the Examiner erred in rejecting claim 7, because a complex rearrangement of the parts of Eda would be required to combine Eda and Kamimura, and it is not clear how or whether such rearrangement would work or why one skilled in the art would attempt it (Reply Br. 6). In particular, the Appellants argue that if Eda's coned disk springs 10b are removed in order to accommodate the backlash mechanism of Kamimura, then Eda would no longer absorb axial loads, and thus the proposed modification would change the principle of operation of Eda's device, and if Eda's coned disk springs 10b are retained, then it is not clear that Eda's support 42 could function under the axial loads imparted by backlash without binding in its support cylinder (*id.*). Further, the Appellants argue that if Eda's shaft 30 is made flexible, as taught in Kamimura, then it is not clear that Eda's device would continue to function, and if Eda's shaft 30 remains rigid, then it is not clear that any benefit could be obtained from Kamimura's elements (*id.*).

The Appellants are arguing, in essence, that one having ordinary skill in the art would not be able to bodily incorporate the biasing mechanism of Kamimura into Eda's system. This is not the test for obviousness. *In re Keller*, 642 F.2d at 425. The Appellants have not argued or presented evidence that the inclusion of a settable biasing mechanism, as taught in Kamimura, in the power-assist steering system of Eda would have been uniquely challenging or difficult for one of ordinary skill in the art. As such,

Appeal No. 2008-1425  
Appl. No. 09/655,847

we turn to the question of what the combined teachings of Eda and Kamimura would have suggested to one having ordinary skill in the art.

On this issue the Appellants contend that because Eda's device already addresses the problem of backlash, one skilled in the art would have no reason to look to Kamimura for a solution to a problem that has already been addressed (Reply Br. 7). We disagree. Eda's device is directed to using static elastic members to provide a predetermined pressure to bearings to eliminate backlash (Facts 6 & 7). Eda's system does not provide means to adjust the pressure supplied by the elastic member to the bearings (Fact 8). On the other hand, Kamimura discloses a worm gear arrangement that accounts for backlash by biasing a worm 23 toward a worm wheel 22 using an adjustable pressing means (Facts 9 & 10). As such, it would have been obvious to one having ordinary skill in the art to add the improvement of the adjustable backlash mechanism of Kamimura to the device of Eda in order to have a backlash mechanism that can apply pressure to the bearing in the radial direction to bias the worm toward the worm wheel and that is adjustable in cases where the pressure force by the spring changes.

Finally, the Appellants contend that even if combined, the combination does not teach or suggest a biasing member movably acceptable only toward a concave member, as claimed (Reply Br. 7). We must first construe the phrase "biasing member movably acceptable only toward a concave member." We determine the scope of the claims in patent applications not solely on the basis of the claim language, but upon giving claims "their broadest reasonable interpretation consistent with the

Appeal No. 2008-1425  
Appl. No. 09/655,847

specification” and “in light of the specification as it would be interpreted by one of ordinary skill in the art.” *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). It is the appellants’ burden to precisely define the invention, not the PTO’s. *In re Morris*, 127 F.3d 1048, 1056 (Fed. Cir. 1997). Appellants always have the opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be interpreted more broadly than is justified. *In re Prater*, 415 F.2d 1393, 1404-05 (CCPA 1969).

The Appellants’ Specification describes the movement of a first embodiment of the biasing member as follows:

A biasing member 30 including a spring body biasing the second bearing 17 in the deflective direction is provided to the gear housing 8.

A concave portion 83 of a circular arc in section accepting movement of the second bearing 17 is formed in a second bearing hole 82 and the second bearing 17 is deflected into the concave portion 83.

(Spec. 10:19-25.)

The biasing member 30 has a curved surface of a circular arc in section contacting an outer circumferential surface of the second bearing 17 and a spring supporting section, and, to be detailed, includes: a spring supporter 31 inserted so as to be movable toward the second bearing hole 82; a spring body 32 of a coil spring supported by the spring supporter 31; a screw body 33 adjusting a flexure amount of the spring body 32 contracted in the tapped hole 84; and a lock nut 34 screwed on the screw body 33. The biasing member 30 deflects the second bearing 17 toward

Appeal No. 2008-1425  
Appl. No. 09/655,847

the concave portion 83 by operating the screw body 33, in a state where the lock nut 34 is loose, to move the spring supporter 31.

(Spec. 11:10-21; Figs. 3 & 4.)

The Specification further describes a second embodiment which uses a screw body as the biasing mechanism:

The electric power steering apparatus of the second embodiment has a structure in which comparing with the first embodiment, neither of the spring body 32 and the spring supporter 31 of the above-mentioned biasing member 30 is present, a screw body 35 is screwed in a tapped hole 84 of the gear housing 8, the screw body 35 being put in contact with the outer circumferential surface of the second bearing 17; the second bearing 17 is deflected toward the concave portion 83 by operating the screw body 35 and further, no first regulatory portion 8a is present.

(Spec. 13, ll. 13-22; Figs. 5 & 6.) The Specification describes this second embodiment in operation as follows:

The second bearing 17 is moved by operating the screw body 35 in a loose condition of the lock nut 20 and the screw body 19 to force the worm 71 to be put in contact with the worm wheel 72. ...

When backlash is produced due to increase in wear of teeth of the worm 71 and the worm wheel 72, the lock nut 20 and the screw body 19 are loosened to release the second bearing 17 from a constrained condition and further, the screw body 35 is operated to deflect the second bearing 17 toward the concave portion 82, thereby enabling backlash to be properly eliminated.

Appeal No. 2008-1425  
Appl. No. 09/655,847

(Spec. 14:4-15:1.) The Specification does not describe that the biasing member of either embodiment is prevented from moving away from the concave member. For example, if one were to adjust the biasing member too far in a direction toward the concave member, the biasing member could be readjusted to move it slightly away from the concave member, e.g., by turning the screw body 33 (first embodiment) or the screw body 35 (second embodiment) in the reverse direction. Nothing in the Specification prohibits such movement of the biasing member. Rather, based on the descriptions of the movement of the biasing member provided in Appellants' Specification, we understand the phrase "biasing member movably acceptable only toward a concave member" to mean that during operation, the biasing member can be moved in a direction toward the concave member in order to bias the bearing toward the concave member. In other words, during operation the intended or acceptable movement of the biasing member is to adjust it toward the concave member.

With that understanding of the claim in mind, we now turn to examine the scope and content of the prior art. Kamimura describes a pressing means that is "set pressing said worm with a set force in the direction of the worm wheel" (Fact 11). In particular, Kamimura describes that "[a] spring 48 that energizes the slider 41 toward the worm wheel 22 is inset between said bearing 45 and slider 41, and as a result, the worm gear 23 is pressed by a fixed elastic force toward the worm wheel 22" (Fact 12). Kamimura also describes that "in cases where the pressure force by said spring 48 changes, the screw-in amount of the adjustment screw 46 can be changed" (Fact 13).

Appeal No. 2008-1425  
Appl. No. 09/655,847

As such, Kamimura describes, in a similar fashion to Appellants' Specification, that, when set, the force of the spring 48 acts only in the direction to deflect or move the bearing toward the worm wheel (Fact 14). The Appellants' argue that because Kamimura shows a gap below the bottom of slider 41, the spring 48 can move both toward and away from bearing 43, and thus Kamimura does not meet the claim (Reply Br. 7). We disagree with the Appellants' interpretation of Kamimura. Although there is a gap shown in Figure 1 of Kamimura below slider 41, the consistent description throughout Kamimura of the operation of its pressing means is to apply a set force to the bearing in the direction of the worm wheel. As such, Kamimura discloses that the only acceptable movement of the pressing means is to adjust it so that a force is exerted on the bearing toward the worm wheel (Fact 14). Thus, the Appellants have failed to show that the Examiner erred in rejecting claim 7 as unpatentable over Eda and Kamimura.

### *Claims 1 and 11*

The Appellants fail to present any separate arguments for patentability of claims 1 and 11. As such, we sustain the rejection of claims 1 and 11 for the same reasons set forth *supra* in our analysis of claim 7.

### *Claim 2*

The Appellants contend the language of claim 2, which recites an interlocking member interlocking the worm shaft and a motor output shaft,

Appeal No. 2008-1425  
Appl. No. 09/655,847

is not addressed in the Examiner's Answer and the art of record does not show or suggest an interlocking member as claimed (Reply Br. 8). We disagree. The Examiner's Answer points to, for example, Figure 13A of Eda as showing the claimed interlocking member (Ans. 3). Indeed, Eda shows and describes that the two shafts are interlocked. Although the description of this interlocking arrangement is provided with respect to the embodiment of Figure 2, we find that this description applies equally to the embodiment shown in Figure 13A. In particular, Eda discloses serrations on the end of worm shaft 30 that interlock with serrations in hole 21b of the output shaft 21a (Facts 1-5). As such, the Appellants have failed to persuade us of error in the Examiner's rejection of claim 2.

#### *Claims 3, 4, and 12*

The Appellants argue that independent claim 12 and dependent claims 3 and 4 are allowable for the same reasons as claim 7. For the same reasons set forth *supra* for claim 7, we are equally unconvinced of error in the Examiner's rejection of claims 3, 4, and 12 as unpatentable over Eda and Kamimura.

#### *Claim 9*

In addition to the arguments made for claim 7, the Appellants argue that the Examiner erred in rejecting claim 9 because the claim requires the housing that directly holds the bearing is the same housing that holds the biasing member, and Kamimura fails to show the same housing holding both

Appeal No. 2008-1425  
Appl. No. 09/655,847

the bearing and the biasing member (Reply Br. 9-10). The Examiner found that Kamimura's arm 42 is a "housing" which houses both the bearing 43 and the spring or biasing means 48 (Ans. 5). Kamimura discloses a slider 41 which includes an arm 42, a bearing 43 rotatably support in an aperture in arm 42, and a spring 48 housed between the leg portions of the lower part of slider 41 (Fact 15).

The question before us is thus whether Kamimura's slider 41 is a "housing." The ordinary meaning of housing is something that covers, protects, or supports, especially: a. A frame, bracket, or box for holding or protecting a mechanical part: *a wheel housing.* b. An enclosing frame in which a shaft revolves (Fact 17). The Appellants' Specification does not provide any definition of housing that is contrary to its ordinary meaning. Thus, housing, as generally understood by one having ordinary skill in the art, is broad enough to encompass Kamimura's slider 41, which holds the spring 48 and the bearing 43. As such, the Appellants have failed to persuade us of error in the Examiner's rejection of claim 9.

#### *Claim 10*

The Appellants contend that the Examiner erred in rejecting claim 10 under 35 U.S.C. § 103(a) as being unpatentable over Eda and Kamimura, because Kamimura shows a bearing that appears to contact the element alleged to be a concave member around the entire circumference of the bearing, and thus the bearing cannot be deflected into the concave member as required by claim 10 (App. Br. 9). Kamimura discloses in Figure 1 that

Appeal No. 2008-1425  
Appl. No. 09/655,847

bearing 43 is rotatably supported in an aperture formed in arm 42 of slider 41 (Fact 15). As such, when slider 41 biases bearing 43 upwardly, both arm 42 and bearing 43 move such that bearing 43 cannot be deflected into the concave member as claimed (Fact 16). Accordingly, we will not sustain the rejection of claim 10 as unpatentable over Eda and Kamimura.

*Claim 14*

The Appellants argue that if element 41 of Kamimura is asserted to be a concave member, then it does not accept a bearing 43 (Reply Br. 9). We understand the Examiner's position to be that the slider element 41 of Kamimura, has a concave member in the form of the aperture or cylindrical bore formed in arm portion 42 of the slider 41, and which accepts bearing 43 (Ans. 4). As such, slider 41 accepts a bearing 43 (Fact 15). Thus, the Appellants have failed to persuade us of error in the Examiner's rejection of claim 14.

## CONCLUSIONS

We conclude the Appellants have failed to show that the Examiner erred in rejecting claims 1-4, 7, 9, 11, 12, and 14 under 35 U.S.C. § 103(a) as unpatentable over Eda and Kamimura. The Appellants have, however, shown that the Examiner erred in rejecting claim 10 under 35 U.S.C. § 103(a) as unpatentable over Eda and Kamimura.

Appeal No. 2008-1425  
Appl. No. 09/655,847

## DECISION

The decision of the Examiner to reject claims 1-4, 7, 9, 11, 12, and 14 is affirmed. The decision of the Examiner to reject claim 10 is reversed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2007).

## AFFIRMED-IN-PART

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BIRCH STEWART KOLASCH & BIRCH LLP  
P O BOX 747  
FALLS CHURCH VA 22040-0747